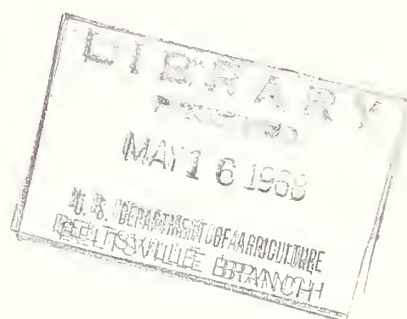


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**POSTHARVEST DECAY OF PEACHES
AS AFFECTED BY
HOT-WATER TREATMENTS,
COOLING METHODS, AND SANITATION**



UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

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POSTHARVEST DECAY OF PEACHES AS AFFECTED BY HOT-WATER TREATMENTS, COOLING METHODS, AND SANITATION

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BACKGROUND

In a research survey of agricultural losses, peach losses annually in the United States during transit and unloading were estimated to be over 3 percent and over an additional 6 percent during marketing in retail stores (7).² Much of these losses was due to decay.

Infections just before harvest and during harvest, packing, and cooling are the principal causes of transit and market losses. These infections are not visible; hence, the infected peaches cannot be eliminated during grading. Refrigeration during transit will control development of these infections, but when peaches are later transferred to

ripening temperatures, infections may develop. Hot-water treatments prevent development of these infections at ripening temperatures, but these treatments offer no protection against additional infections (4, 6).

This report will show the relation of unsanitary procedures, especially during hydrocooling, to market decays of peaches and show how such contamination can be avoided. Information is also given on peach temperatures during heating and cooling and on the commercial application of heat treatment to peaches.

PART I. RELATION OF HYDROCOOLING TO DECAY

Materials and Methods

Freshly harvested peaches obtained from an orchard relatively free of brown rot were sorted for equal maturity and freedom from bruises or other injuries.

In some tests, these peaches were inoculated with *Monilinia fructicola* (Wint.) Honey (brown rot) or *Rhizopus stolonifer* (Fr.) Lind. spores and held at 70° F. for 24 hours before treatment to permit the spores to germinate and penetrate beneath the skin of the peaches. In other tests, the peaches were not inoculated.

The peaches were hydrocooled as follows: (a) In spore-free clean water; (b) in spore-free clean water with enough sodium hypochlorite added to raise chlorine concentration of hydrocooling water to about 100 parts per million (p.p.m.); (c) in water containing *Monilinia* or *Rhizopus* spores (spore seeded); and (d) in water containing *Monilinia* or *Rhizopus* spores and enough sodium hypochlorite added to raise the chlorine concentration of the hydrocooling water to about 100 p.p.m. Time of hydrocooling ranged from 10 to 15 minutes.

The peaches were separated into two comparable lots. One lot was heated in 120°, 125°, or 130° F. water for 3 minutes before hydrocooling. The other lot was not heated. After treatment all peaches were held for 2 days at 50° and for 4 additional days at 70° before being evaluated for decay.

Most of the data were analyzed by the analysis of variance and differences between means at the 5-percent level of significance determined by the Duncan multiple range test.

Results

Inoculated Peaches

Nonheated inoculated peaches hydrocooled in spore-free water developed a high percentage of decay that was reduced significantly when the peaches were heated in 130° F. water for 3 minutes before hydrocooling (table 1). The addition of chlorine to the spore-free hydrocooling water reduced decay slightly, but the reduction was not statistically significant. Both heat-treated and nonheated peaches hydrocooled in spore-seeded water

¹ Mr. Redit retired in April 1967.

² Italic numbers in parentheses refer to Literature Cited, p. 9.

TABLE 1.—*Decay of heated and nonheated inoculated peaches hydrocooled in spore-free or spore-seeded water with or without chlorine*¹

Hydrocooling water	Peaches developing brown rot		Peaches developing rhizopus decay	
	Heated ²	Nonheated	Heated ²	Nonheated
	Percent	Percent	Percent	Percent
Spore-free:				
Without chlorine.....	25.8 ab	59.8 cd	39.2 ab	64.3 bc
With chlorine ³	12.5 a	44.6 bc	26.7 a	63.5 bc
Spore-seeded: ⁴				
Without chlorine.....	73.3 d	66.1 cd	80.0 c	78.2 c
With chlorine ³	14.8 a	42.2 bc	16.8 a	63.8 bc

¹ Peaches held 2 days at 50° F., then 4 days at 70° F. following each treatment. Each value is mean of 6 tests of 20 peaches in each treatment. Percentages in each column followed by same letter or letters do not differ significantly at 5-percent level.

² 130° F. water for 3 minutes before hydrocooling.

³ Chlorine concentration about 100 p.p.m.

⁴ Water contaminated with *Monilinia* (brown rot) or *Rhizopus* spores.

developed high percentages of decay, showing that the heat-treated peaches were reinoculated by the contaminated water. Chlorine alone in spore-seeded hydrocooling water reduced decay slightly, but a combination of heat treatment followed by hydrocooling in water containing chlorine reduced decay very effectively.

Noninoculated Peaches

The nonheated, noninoculated peaches hydrocooled in spore-free water developed relatively little decay. Heating such peaches in 130° F. water for 3 minutes before hydrocooling, or adding chlorine to the hydrocooling water, had no significant effect on decay development (table 2). Hydrocooling in spore-seeded water greatly increased decay, particularly when the water contained *Monilinia* spores, or when heated peaches were hydrocooled in water containing *Rhizopus* spores. Heated peaches hydrocooled in spore-seeded water developed significantly more decay than nonheated

ones. The addition of chlorine to the spore-seeded water effectively reduced decay of both heated and nonheated peaches.

Tables 1 and 2 show that peaches previously heated for 3 minutes in 130° F. water are inoculated more readily than nonheated ones when they are hydrocooled in chlorine free water containing decay-producing spores. Studies were then conducted to determine if peaches previously heated in 120° or 125° water would be inoculated after treatment to the same extent as those heated in 130° water. Noninoculated peaches almost free of field infections were tested.

When peaches were hydrocooled in spore-free water, there was no significant difference in decay that developed on heated and nonheated peaches (table 3). A tendency existed, however, for more decay to develop on peaches heated in the higher temperature water, indicating that these fruit were more susceptible to contamination. The high percentage of decay that developed in the peaches hydrocooled in spore-seeded water indicated the ease with which peaches can be inoculated in the

TABLE 2.—*Decay of heated and nonheated, noninoculated peaches hydrocooled in spore-free or spore-seeded water with or without chlorine*¹

Hydrocooling water	Peaches developing brown rot		Peaches developing rhizopus decay	
	Heated ²	Nonheated	Heated ²	Nonheated
	Percent	Percent	Percent	Percent
Spore-free:				
Without chlorine.....	17.1 a	0.8 a	7.1 a	6.4 a
With chlorine ³	2.0 a	0 a	8.9 a	7.0 a
Spore-seeded: ⁴				
Without chlorine.....	89.4 c	56.6 b	54.4 b	19.5 a
With chlorine ³	3.3 a	0 a	5.0 a	8.4 a

¹ Peaches held 2 days at 50° F., then 4 days at 70° F. after treatment. Each value is the mean of 8 tests of 20 peaches in each treatment. Percentages within a block followed by the same letter or letters do not differ significantly at 5-percent level.

² 130° F. water for 3 minutes before hydrocooling.

³ Chlorine concentration about 100 p.p.m.

⁴ Water contaminated with *Monilinia* (brown rot) or *Rhizopus* spores.

TABLE 3.—*Decay of heated and nonheated, non-inoculated peaches hydrocooled in spore-free and spore-seeded hydrocooling water*¹

Temperature (° F.) of treating water ²	Hydrocooling water	Peaches developing brown rot	Peaches developing rhizopus decay
		Percent	Percent
70 (nonheated)...	Spore-free----	2.3 a	0 a
120-----	-----do-----	2.1 a	0 a
125-----	-----do-----	11.0 a	2.6 a
130-----	-----do-----	20.9 a	7.7 ab
70 (nonheated)...	Spore-seeded ³	64.1 b	24.4 bc
120-----	-----do-----	73.9 b	38.9 c
125-----	-----do-----	84.9 bc	41.3 cd
130-----	-----do-----	96.9 c	56.4 d

¹ Peaches held 2 days at 50° F., then 4 days at 70° after treatment. Each value is the mean of 6 tests of 20 peaches each in treatment. Percentages within a block followed by the same letter do not differ significantly at the 5-percent level.

² 3-minute treatment before hydrocooling.

³ Water contaminated with *Monilinia* (brown rot) or *Rhizopus* spores.

hydrocooler. Peaches heated in 130° F. water and hydrocooled in spore-seeded water developed significantly more decay than those heated in 120° water or the nonheated peaches.

Discussion

These data show that postharvest decay of peaches can be increased by unsanitary procedures.

PART II. RELATION OF AIR COOLING TO DECAY

Data in the previous section show that unless careful sanitation is practiced peaches may become contaminated by hydrocooling water. Studies were made, therefore, to determine the effects of air cooling on fruit contamination.

Materials and Methods

Two types of cooling were used: (a) Cool (room-cooled at 32° F.) peaches were treated with 120°, 125°, 130°, or 135° water; and (b) warm (70°) peaches were treated with hot water and then placed in a 50° room. Temperatures under the skin of each lot were taken with thermocouples before and during heating, and at the pit before and after heating. In some tests, both lots of fruit were inoculated with *Monilinia* or *Rhizopus* spores for 24 hours before treatment with hot water. In other tests, the fruit were not inoculated. Decay of the heated peaches was compared with that of nonheated peaches after the peaches were held 2 days at 50° and 4 days at 70° following treatment.

Results

Decay

With inoculated fruit, each hot-water treatment significantly reduced brown rot of cool and warm

Hydrocooling water, in particular, is an important medium where peaches may become contaminated with decay-producing organisms. Chlorination of the hydrocooling water very effectively prevented such contamination. In these studies chlorine was added to clean water containing *Monilinia* or *Rhizopus* spores. Chlorine disappears rapidly when organic matter is present in water (1, 3); therefore, for maximum effectiveness of chlorine, the hydrocooling water should be as free as possible of organic matter. To avoid contamination of peaches and the buildup of organic matter in the water, commercial hydrocoolers should be thoroughly cleaned and the water changed daily. The chlorine concentration of the water should be tested at least every hour to maintain the desired chlorine concentration of 100 p.p.m.

Hot-water treatments effectively prevent development of decay-producing organisms on and in peaches and aid in preventing buildup of these organisms in packing sheds. Such heat treatments can be considered a form of sanitation. If the packing shed and hydrocooling water are not previously cleaned, contamination of hot-water-treated peaches may make this treatment ineffective as a postharvest method of decay control. Since peaches heated in 130° F. water are more subject to contamination than those heated in lower temperature water, it is suggested that for safe application and effective decay control water temperatures near 125° and exposure times of 2 to 3 minutes should be used.

peaches below that of the nonheated peaches (table 4). Cool peaches heated in 130° and 135° F. water developed significantly less brown rot than those heated in 120° water. Differences in reduction of rhizopus decay of cool peaches by the various hot-water temperatures were not significant. Only those heated in 130° or 135° water had significantly less rhizopus decay than the nonheated peaches. All of the hot-water treatments significantly reduced rhizopus decay of warm peaches. Warm peaches treated with 135° water developed considerably more rhizopus decay than any of the other heat-treated peaches. Many of the warm peaches treated in 135° water had brown streaks and mottling on the skin indicative of heat damage. Such damage probably made the peaches susceptible to *Rhizopus* contamination from the air. Similar, but less pronounced, injury occurred when cool peaches were heated in 135° water, and sometimes when cool or warm peaches were heated in 130° water.

Nonheated, *Rhizopus*-inoculated peaches held at 32° F. for 24 hours developed significantly less decay than the warm peaches (table 4). The reduction of this decay can be attributed to the drying of wounds at 32°, preventing the entrance of this organism. Information on the effect of low tem-

TABLE 4.—*Decay of inoculated and noninoculated peaches held at 32° and 70° F. for 24 hours before treating with room temperature or hot water*¹

Holding temperature and temperature of treating water (°F.) ²	Peaches developing decay inoculated with—		Noninoculated peaches developing decay ³
	<i>Monilinia</i> spores	<i>Rhizopus</i> spores	
32:	Percent	Percent	Percent
70 (nonheated)---	88.8 c	43.8 c	2.5
120-----	45.0 b	21.3 abc	1.3
125-----	27.5 ab	23.8 abc	5.0
130-----	8.8 a	16.0 ab	1.3
135-----	7.5 a	7.5 a	7.5
70:			
70 (nonheated)---	90.0 c	78.8 d	1.3
120-----	9.0 a	7.8 ab	7.5
125-----	7.5 a	20.0 ab	0
130-----	5.0 a	3.8 a	2.5
135-----	13.8 a	38.8 bc	3.8

¹ Peaches held 2 days at 50° F., then 4 days at 70° after treatment. Each value is the mean of 4 replicates of 20 peaches each. Percentages within a column followed by the same letter or letters do not differ significantly at the 5-percent level.

² 2-minute treatment in 135° F. water, 3-minute treatment in other temperature water.

³ Brown rot and rhizopus decay. Differences among treatments are not significant.

perature on *Rhizopus* infection of peaches has been previously published (2, 5).

When noninoculated peaches with a low percentage of natural infection were held at either 32° or 70° F. for 24 hours, a low percentage of decay developed (table 4). The difference between the percentage of decay that developed on the nontreated and heat-treated fruit was not significant. This is in strong contrast to data obtained on noninoculated peaches hydrocooled, especially when peaches were hydrocooled in contaminated water (table 2).

Fruit Temperatures

Temperatures under the skin of the peaches previously held at 70° F. increased most rapidly during the first 1½-minute exposure to hot water (fig. 1). After a 1½-minute exposure in each of the hot-water treatments, temperatures of the peaches were as high as or higher than those from 32° storage after 2–3 minutes at the same treating temperatures.

Temperatures under the skin of the peaches previously held at 32° F. increased to about 49° during the 3–5 minutes they were held at room temperature (70°–80°) before they were treated with hot water. During treatments, these temperatures increased very rapidly during the first ½ minute (fig. 1). At this time temperatures of peaches heated in 135° water were about 5 degrees higher than those heated in 120° water. Temperature rise during the rest of the exposure periods was more gradual. Peaches heated in 130° or 135° water for 1½ minutes, however, had temperatures considerably higher than those heated in 120° or 125° water for 3 minutes.

After heat treatment, temperatures at the pit of the peaches from 32° F. were considerably lower than those from 70°. Pit temperatures of the 32° fruit, regardless of the temperature of the treating water, averaged about 49° or about the same as the skin temperature before the peaches were treated. Pit temperatures of the 70° fruit increased from about 70° to 75° during treatment.

Discussion

Air cooling can be used as an alternate method to hydrocooling to remove heat from peaches. When inoculated fruit were precooled at 32° F. for 24 hours before hot-water treatments, decay was effectively reduced. Temperatures under the skin and near the pit of these fruit after the hot-water treatments were low enough to prevent undue ripening during transit, and were comparable to those obtained by normal hydrocooling procedures. Air cooling at 32° before hot-water treatment will also eliminate the danger of contamination from hydrocooling water. Hot-water-treated fruit may also be cooled at 50° after heating and avoid the danger of contamination. If large lots of fruit are used, air temperatures lower than 50° should be used. Successful use of air cooling at 32° after heating has been previously reported (6).

When precooled peaches are treated with hot water, water temperature should be maintained between 125° and 130° F. Greater reduction in decay was obtained when fruit was treated at these temperatures than at 120°. Temperatures above 130° should be avoided to reduce chances of fruit injury. When temperature data of inoculated fruit at 32° and 70° (fig. 1) are compared with decay reduction by the heat treatment (table 4), it appears that fruit temperatures under the skin must reach about 105° for at least a minute to effectively kill fungus spores and young vegetative mycelium.

PART III. COMMERCIAL TESTS WITH HOT-WATER-TREATED PEACHES

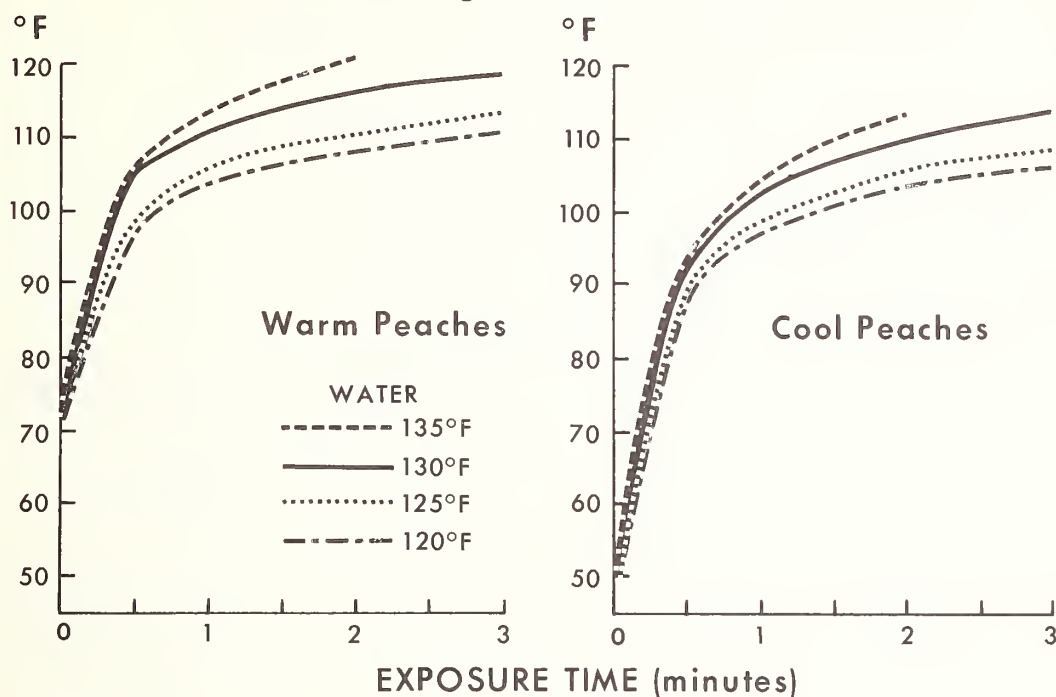
Materials and Methods

Peach temperatures at various stations in the packing line before and after treating with hot

water were obtained in two commercial peach-packing sheds. At each station 20 peaches were selected and their temperatures just under the skin and near the pit were taken with copper constan-

PEACH TEMPERATURE UNDER SKIN

During Hot-Water Treatments



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FIGURE 1

tan thermocouples attached to a direct reading potentiometer. The operations in the two sheds were as follows:

Shed A.—Peaches were received from the field in picking boxes and mechanically dumped into a tank of water about 127° F. for 2 to 2¼ minutes. After this treatment, the peaches were elevated onto a wet brusher (defuzzer) and then they were graded, sized, and packaged into ¾-bushel containers. These containers of fruit were then hydrocooled in a flood-type hydrocooler. The hydrocooling process usually lasted about 14 minutes, and the water temperature in the hydrocooler was usually about 35°.

Shed B.—Peaches were received from the field in 20-bushel pallet boxes that were held in a refrigerated storage room until the fruit was sorted for shipping. On removal from the refrigerated room, the pallets of fruit were submerged into a tank of 65° F. water. The fruit floated to a roller elevator and was given a preliminary rinsing and brushing, then heated for 2–3 minutes in water about 125°. Following this treatment, the peaches were wet brushed and cooled immediately in a bulk-type

hydrocooler for about 9 minutes in about 34° water. After hydrocooling, the peaches were graded and packaged.

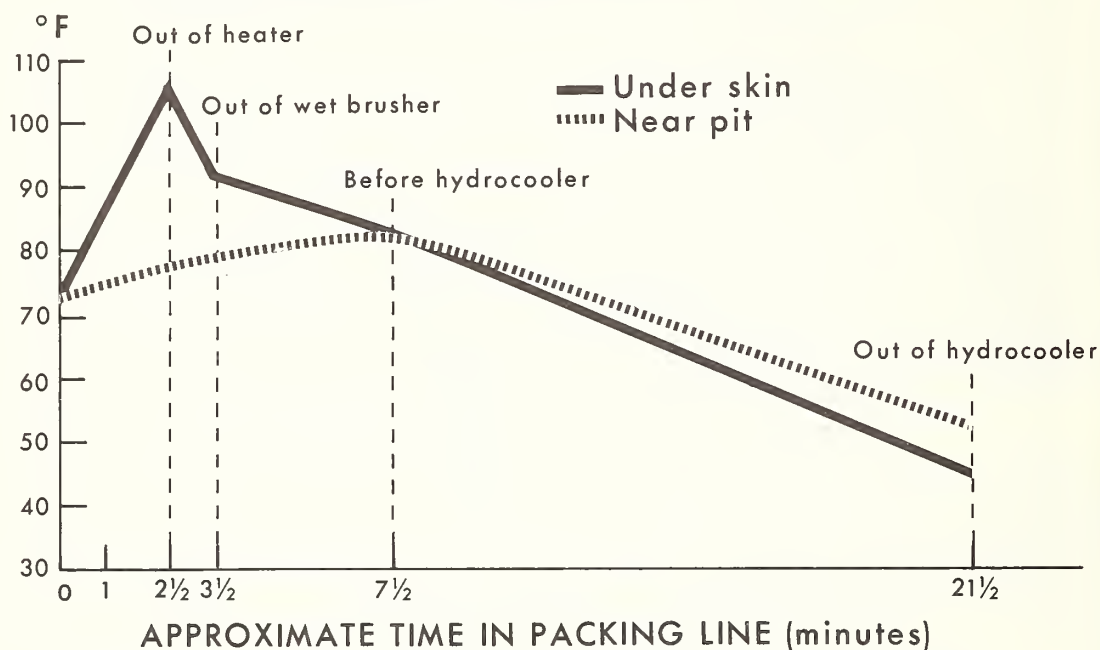
Results

Temperatures—Shed A

Nine tests were conducted. Peach temperatures averaged 73° F. when the peaches were dumped into the hot water (table 5 and fig. 2). After a 2- to 2¼-minute exposure in about 127° water, the temperature under the skin increased about 33° and at the pit about 5°. Wet brushing decreased the temperature under the skin about 14°, but did not usually affect pit temperatures. By the time the peaches entered the hydrocooler, temperatures under the skin were lowered an additional 8°, but the pit temperature had increased 4°. Temperatures under the skin and at the pit, therefore, were about 10° higher when the peaches entered the hydrocooler than when they were received from the field. When the peaches were removed from the hydrocooler, temperatures under the skin averaged 45.5° and at the pit 53°.

PEACH TEMPERATURE

During Commercial Heating and Cooling*



*SHED A, PACKED IN $\frac{3}{4}$ -BUSHEL CONTAINERS BEFORE HYDROCOOLING

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FIGURE 2

TABLE 5.—Commercial packing shed A: Temperatures of peaches at various stations in packing line after a 2- to 21 $\frac{1}{4}$ -minute exposure in hot water

Test No.	Heater		Hydrocooler ¹		Temperature under skin					Temperature near pit				
	Water temperature	Exposure time	Water temperature	Exposure time	Into heater	Out of heater	Out of wet brusher	Into hydrocooler	Out of hydrocooler	Into heater	Out of heater	Out of wet brusher	Into hydrocooler	Out of hydrocooler
	°F.	Min.	°F.	Min.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
1.....	131	2	35	15.0	76.0	108.0	91.7	86.4	44.5	75.5	80.8	80.2	85.6	43.7
2.....	125	2	35	14.5	73.7	105.2	91.7	82.8	42.1	72.8	79.3	77.8	81.8	50.6
3.....	128	2	36	15.0	74.7	109.9	93.0	84.3	45.5	74.5	80.3	81.2	85.4	49.9
4.....	128	2	34	15.5	66.2	105.9	89.4	81.4	41.8	65.6	71.2	73.6	78.5	51.9
5.....	127	2	34	15.5	68.6	103.5	92.1	83.7	45.1	67.6	73.9	75.9	80.9	51.5
6.....	124	21 $\frac{1}{4}$	35	9.25	72.9	105.1	93.2	85.1	47.5	72.2	82.4	81.9	82.7	66.1
7.....	128	21 $\frac{1}{4}$	34	13.0	77.4	107.5	94.9	85.6	49.7	76.5	84.4	83.9	86.3	55.9
8.....	128	21 $\frac{1}{4}$	34	13.0	78.4	108.6	92.2	83.5	46.8	77.7	79.5	79.9	83.7	54.4
9.....	126	21 $\frac{1}{4}$	34	13.0	70.5	105.0	89.6	82.5	46.1	68.8	74.1	74.7	80.3	53.0
Mean.....	127.2	-----	34.6	13.75	73.2	106.5	92.0	83.9	45.5	72.4	78.4	78.8	82.8	53.0

¹ Overhead flood-type hydrocooler (peaches packed in $\frac{3}{4}$ -bushel containers before cooling).

Temperatures—Shed B

Five tests were conducted. Temperatures under the skin of the peaches averaged 54° and 49° F. at the pit when the fruit entered the water dump

(temperature 65°) (table 6 and fig. 3). By the time the peaches entered the hot-water tank, the temperatures had increased about 7° under the skin and 3° near the pit. Heating in 125° water

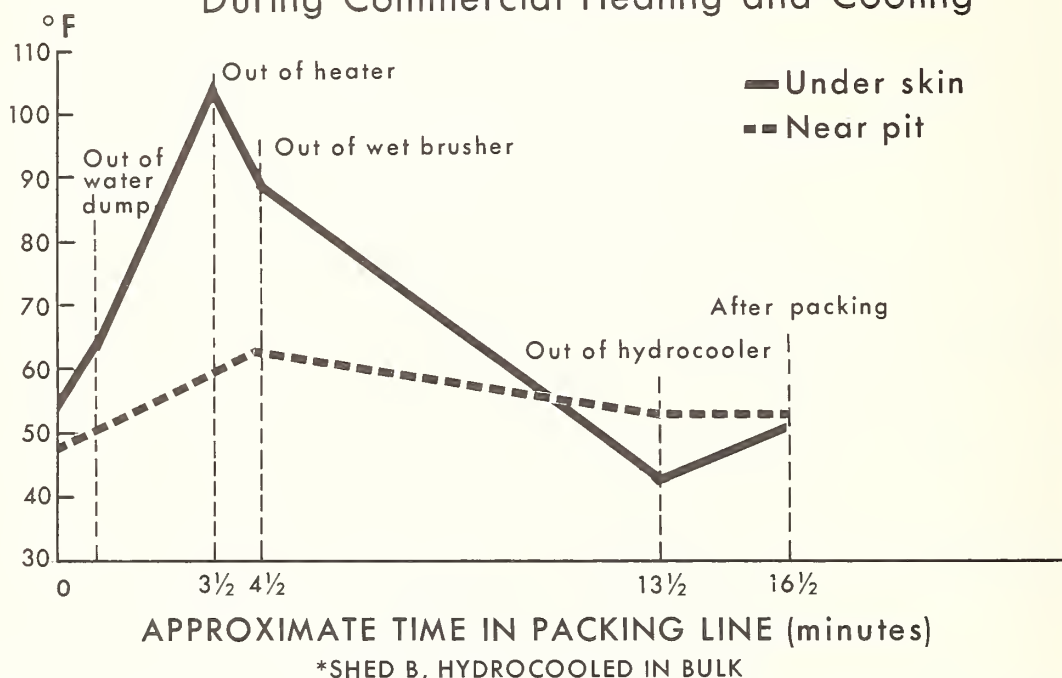
TABLE 6.—Commercial packing shed B: Temperatures of peaches at various stations in packing line after a 2- to 3½-minute exposure in hot water

Test No.	Heater		Hydrocooler ¹		Temperature under skin						Temperature near pit					
	Water tem- perature	Exposure time	Water temperature	Exposure time	Into water dum	Out of water dum	Out of heater	Out of wet brusher	Out of hydro- cooler	After pack- ing	Into water dum	Out of water dum	Out of heater	Out of wet brusher	Out of hydro- cooler	After pack- ing
1	122	3 1/2	40	10.0	54.5	62.8	102.7	89.8	47.6	54.9	48.3	50.1	61.2	64.1	56.0	56.6
2	127	2 1/4	33	9.5	52.5	61.0	105.4	82.2	42.2	52.8	45.4	49.2	55.0	57.4	48.9	48.9
3	126	2 1/4	34	9.5	52.3	61.8	104.6	86.7	43.1	49.2	45.8	46.9	57.5	55.6	48.5	48.9
4	126	2 1/4	36	9.5	47.6	60.6	103.9	85.6	42.2	48.3	42.6	49.0	55.0	55.5	49.6	48.0
5	125	2 1/4	36	9.5	64.2	63.2	105.0	94.8	43.9	48.9	63.7	61.1	72.3	76.7	54.9	54.7
Mean	---	---	---	---	54.2	61.9	104.3	87.8	43.8	50.8	49.2	51.3	60.2	61.9	51.6	51.6

Bulk flood-type hydrocooler (peaches cooled in bulk).

PEACH TEMPERATURE

During Commercial Heating and Cooling*



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FIGURE 3

for 2–3 minutes increased the temperature under the skin about 43° and near the pit about 9°. Temperatures under the skin were lowered about 17° by the wet brusher (water temperature about 65°). After bulk hydrocooling, temperatures under the skin averaged 43.8° and near the pit 51.6°. Temperatures under the skin after packing increased to 50.8°, but pit temperatures did not change. Air temperature during these tests averaged about 75°.

Peach Decay

In shed A, incipient brown rot, appearing as pin rot, was a serious problem. Seven tests were made to determine the effect of hot-water treatment against this infection. Random samples of peaches were selected as they came from the field. One-half of the fruit of each sample (about a bushel) was heated in 127° F. water for 2–2¼ minutes; the other half was not heated. All fruit were then brushed and hydrocooled in the commercial hydrocooler and held at shed temperatures for 2 days at which time the fruit were soft ripe.

The hot-water treatment reduced decay of these peaches from about 30 to 5 percent (table 7). Pin-rot lesions on the treated fruit, for the most part, did not develop into active decay, whereas in untreated fruit, pin-rot lesions rapidly enlarged and most of the fruit decayed.

TABLE 7.—*Shed A peaches: Decay of heated and nonheated and hydrocooled peaches after being held 2 days at shed temperatures*

Variety	Decay of heated peaches ¹	Decay of non-heated peaches
	Percent	Percent
Coronet.....	4	17
Coronet.....	6	27
Coronet.....	6	44
Red cap.....	2	41
Cardinal.....	11	38
Southland sport.....	5	31
Keystone.....	3	16
Mean.....	5.3	30.6

¹ 127° F. water for 2 to 2¼ minutes.

GENERAL DISCUSSION AND CONCLUSIONS

Hot-water treatments have consistently reduced both brown rot and rhizopus decay when the organisms are either on the surface or under the skin of the fruit (pin rot). A 2- to 3-minute exposure at 125° F. is recommended for effective treatment. Temperatures just under the skin of the peaches during this treatment increase rapidly and are apparently high enough to kill decay-producing organisms. Internal flesh and pit temperatures increase only slightly so that the hot-water treatment has little effect on the rapidity of the subsequent cooling of the fruit. Danger of skin burning occurs when peaches are treated in 130° to 135° water even for relatively short periods. Peaches cooled before heat treatment should be treated at 125° to 130°.

Under commercial conditions large quantities of peaches treated with hot water probably cannot be cooled sufficiently with only transit refrigeration to prevent undue ripening. Therefore, some method of cooling before or after heating in the packing plant is necessary. Possibilities of hydrocooling

and air cooling were investigated in this study. Hydrocooling is an excellent method of removing heat from the peaches, but there is danger of increasing decay of the fruit by contaminated water in the hydrocooler. If heated peaches are to be hydrocooled, strict sanitation of the hydrocooler and packing shed must be practiced. To lessen chances of contamination, and to avoid buildup of organic matter in the water in hydrocoolers, water should be changed daily. Chlorination (100 p.p.m.) of clear hydrocooling water is a good method of inactivating spores of contaminating microorganisms. Air cooling before or after heat treating is also an effective method of cooling and eliminates the danger of contamination of the peaches in hydrocooling water.

The effectiveness of the hot-water treatment in destroying pathogenic organisms in and on fruit under commercial conditions also indicates that this treatment may be useful in maintaining sanitation in packing houses.

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